images by applying each individual point in the template image to the fusing transform.

Claims 1-9

Independent claim 1 is directed to a method of displaying an image on a screen by describing at least a portion of a base image as a path, performing a non-affine transform on the path to produce a transformed path, and rendering the transformed path onto a computer screen.

In the Office Action, it was asserted that col. 6, lines 16-67; col. 7, lines 1-10; and Figs. 2, 3 of Miller show a step of describing at least a portion of a base image as a path. Applicants respectfully dispute this assertion.

As defined in the present specification, a path is a set of equations that describe a set of pixels within a base image. (p. 2, lines 9 and 10) Such a description of a base image is not shown in the cited section of Miller. Instead, the cited section describes a transform from a base image to a target image. This transform, shown as arrows in Fig. 2, is not a "path" as that term is used in the present specification because it does not describe a portion of the base image. Instead, it merely describes how the location of an item in one image is associated with the location of the same item in another image.

The Office Action also asserted that Miller showed a step of performing a non-affine transform on a path at col. 28, lines 65-67; col. 29, lines 1-12; col. 16-18; Figs. 7 and 10-11. Although the cited sections discuss non-affine transforms, they do not discuss transforms of paths. Instead, they describe transforms of individual points. (Miller at Col. 6, lines 56 to Col. 7 line 5)

In contrast, claim 1 provides a method of transforming equations (paths) to form transformed paths, and rendering the transformed paths onto the screen. Thus, in claim 1 the

transformations are function-to-function rather than point-to-point as described in Miller.

The distinction between point transforms and path transforms is significant. In particular, point transforms are computationally intensive because a separate transform must be performed for each point in the target image. For example, in Miller, the number of transforms that must be performed to register the template image to the target image is equal to the number of points in the region of interest. Thus, for a volume defined by 128x128x128 points (2,097,152 total points), 2,097,152 transforms must be performed. (See Miller Col. 7, line 63 - Col. 8, line 5). With a path transform, however, fewer transforms need to be performed because multiple points can be transformed with a single transform of the path that represents those points. This reduction in the number of transforms that have to be performed produces a substantial computational savings. As such, the invention of claim 1 provides a significant advantage over the prior art such as Miller.

Because Miller does not show or suggest describing a portion of an image as a path or of transforming a path, it does not show or suggest the invention of claim 1. As such, claim 1 and claims 2-20, which depend therefrom, are patentable over Miller.

Claim 2

Claim 2 depends from claim 1 and includes a further limitation wherein the non-affine transform is a bilinear transform. In rejecting claim 2, the Office Action asserted that col. 3, lines 32-67 of Miller show a bilinear transform. Applicants respectfully dispute this assertion.

Although the cited section discusses linear mapping methods, it does not discuss bilinear transformations. In the present specification, a bilinear transform is defined as a

transform that would cause a square box in the base image to be transformed into a quadrilateral.

Miller does not describe or suggest such a transform. As such, it does not anticipate claim 2.

Claims 3-6, 8

The Office Action rejected claims 3-6 and 8 by asserting that col. 1, lines 50-67; and col. 20, lines 38-67 of Miller show a step of describing a portion of a base image using a function of order n and 2n. Applicants respectfully dispute this assertion.

The first cited section discusses background art relating to brain imaging. In this prior art, a number of points, N, are mapped from one image to another image.

Thus, a portion of the base image is not being described as a function of order n but instead simply has N points. As those skilled in the art recognize, a function of order n means that at least one variable is taken to the n^{th} power in the function. The first cited section in Miller does not show such a function.

The second cited section discusses a fast method for landmark deformations given small numbers of landmarks. As with the first cited section, the reference to N in this section represents the number of points to be mapped.

Because Miller describes N as the number of points to be mapped and the present specification and claims refer to n and 2n as the order of some function, Miller does not anticipate claims 3-6 and 8. As such, claims 3-6 and 8 are patentable over Miller.

Claims 5-7

In the Office Action, claims 5-7 were rejected by asserting that col. 9, lines 40-67; col. 10; and Figs. 3-8 of Miller show describing a portion of a base image as a function of order one and three and a non-affine transform comprising

performing a perspective transform. Applicants respectfully dispute these assertions.

The cited section of Miller does not describe a portion of the base image as a function of order one or three. It does mention that points along curves, surfaces and volumes may be used to identify a registration transform. However, it never shows an equation that represents these curves, surfaces or volumes. As such, Miller does not show or suggest describing a portion of an image using a function of order one or three.

In addition, Miller does not show or suggest a perspective transform. As found in the present specification, a perspective transform involves transforming a two-dimensional image into a three-dimensional image and then projecting the three-dimensional image onto a two-dimensional surface. Miller never shows or suggests such a transform. Therefore, Miller does not anticipate claims 5-7.

Claim 9

Claim 9 was rejected in the Office Action by asserting that cols. 1, 4, 10 and 11 and Fig. 1 of Miller show the step of approximating the transformed path as a series of lines and rendering each line in the series of lines. Applicants respectfully dispute this assertion.

The cited sections of Miller do not make any mention of approximating an equation or path as a set of lines in order to render the path. In fact, Miller has no need for such an approximation since it transforms each point in the base image. As a result, the transformed image can be rendered simply by rendering each transformed point.

Because Miller does not show or suggest approximating a path as a set of lines, it does not anticipate claim 9.

Claims 21-26

Independent claim 21 recites a computer-readable medium having computer executable components for performing steps

comprising generating a function to describe an image for a computer screen; transforming the function using a non-affine transform to produce a transformed function; and converting the transformed function into an image on the computer screen.

As noted above, Miller does not show a step of describing a portion of a base image as a function nor a step of transforming such a function into a transformed function. Applicants reiterate that the apparatus described in Miller performs point-to-point transformations from a template image to a target image for the purpose of accurately registering the images. In contrast, claim 21 describes a computer readable medium having components that perform function-to-function transforms.

Because Miller does not describe a portion of an image with a function nor transform a function, it does not anticipate claim 21 nor claims 22-26, which depend therefrom. As such, claims 21-26 are patentable over Miller.

Claim 22

The Office Action rejected claim 22 by asserting that col. 3, lines 48-67 and Fig. 9 of Miller disclose a smooth curve and the calculation of curvature. The cited section, however, does not disclose representing a portion of a base image as a smooth curve as is found in claim 22. Instead, it discusses the difference between small deformation transforms and large deformation transforms. In particular, it notes that small deformation transforms are not one-to-one because more than one point in the base image can be mapped to the same point in the target image. Because of this, surface areas, curvatures and tangents cannot be determined using small deformation transforms.

Thus, although Miller includes the word curvature, it does not show or suggest generating a function that represents a smooth curve in a base image as found in claim 22. As such, Miller does not anticipate claim 22.

CONCLUSION

In light of the above remarks, claims 1-30 are patentably distinct from the cited art. Reconsideration and allowance of claims 1-30 is respectfully requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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